



Space Life and Physical Sciences Status

Briefing to the Research Subcommittee

D. Marshall Porterfield PhD.
Director, Space Life and Physical Sciences
Human Exploration & Operations Mission Directorate

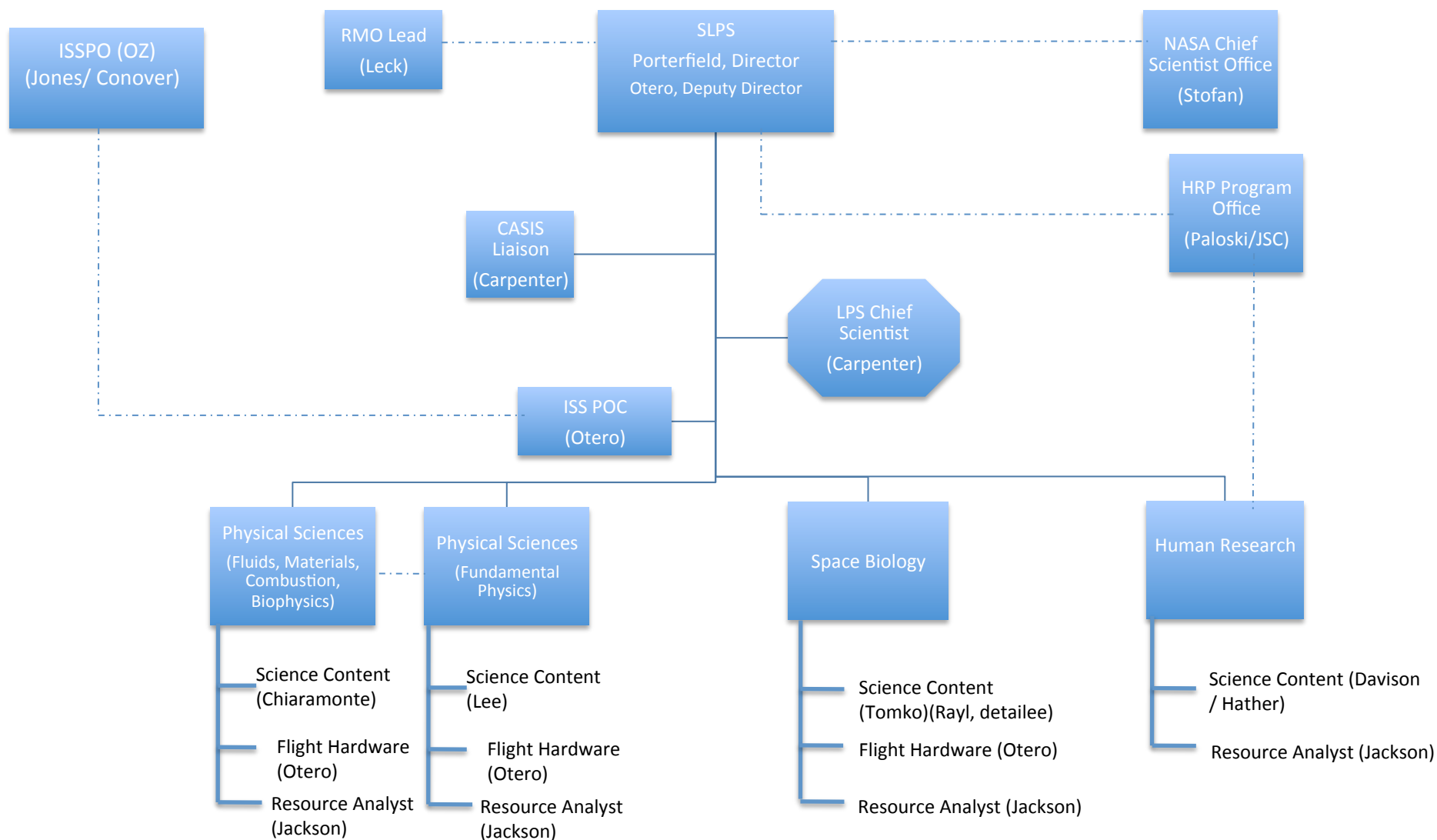
February 24, 2014

Biological and Physical Sciences



- **NASA's Space Life and Physical Sciences Research and Applications Division (SLPS) has been formulated to execute high quality, high value research and application activities in the areas of:**
 - Space Biology
 - Physical Sciences
 - Human Research
- **These programs conduct fundamental and applied research to advance basic knowledge and to support human exploration in the environment of space.**
- **Division serves as the Agency liaison with the ISS National Laboratory management organization, the Center for the Advancement of Science in Space (CASIS).**

SLPSRA Organization Chart



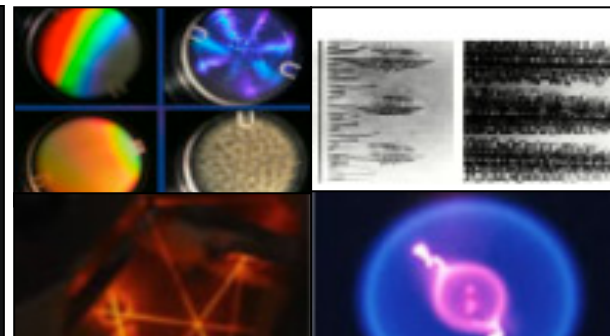
SLPS Research and Application Focus Areas



Space Biology



Human Research



Physical Sciences

- Uses the space environment to enhance understanding of the response of living organisms and biological processes to spaceflight conditions.
 - Works toward an understanding of the requirements of terrestrial life in non-Earth environments. Provides access to model biomedical research systems.
- Develops scientific and technological foundations for a safe, productive human presence in space for extended periods.
 - Focuses on investigating and mitigating the highest risks to human health and performance in order to enable safe, reliable, and productive human space exploration.
- Conducts fundamental and applied research in space to explore the processes that form materials and determine the performance of fluid, thermal, and combustion systems.
 - Builds engineering knowledge to enable the design of fluid, thermal, and chemical process devices for future space exploration systems.
- Applies this knowledge and technology to improve our Nation's competitiveness, education and the quality of life on Earth. Creates the new discoveries for CASIS activities.



SLPS and the NASA Budget

- **SLPS has two budget elements – Human Research Program and Biological and Physical Sciences**
- **Human Research Program is budgeted within Exploration Research and Development**
- **Biological and Physical Sciences is budgeted within the International Space Station Program**
- **The President's 2015 Budget is expected to be released next month**

2014 Exploration Budget



FY 2014 PRESIDENT'S BUDGET REQUEST SUMMARY National Aeronautics and Space Administration

Budget Authority (\$ in millions)	Fiscal Year						
	Actual 2012 ¹	Estimate 2013 ²	Request 2014	2015	Notional 2016	2017	2018
Exploration	3,707.3	3,790.1	3,915.5	3,952.0	3,970.7	3,799.0	3,589.3
Exploration Systems Development	3,001.6	0.0	2,730.0	2,789.8	2,801.5	2,818.3	2,819.5
<u>Orion Multi-Purpose Crew Vehicle</u>	<u>1,200.0</u>	-	<u>1,026.8</u>	<u>1,024.9</u>	<u>1,027.1</u>	<u>1,027.1</u>	<u>1,028.3</u>
Crew Vehicle Development	1,159.8		993.5	997.8	1,001.8	1,001.3	1,002.6
MPCV Program Integration & Support	40.2		33.4	27.1	25.3	25.8	25.8
<u>Space Launch System</u>	<u>1,497.5</u>	-	<u>1,384.9</u>	<u>1,356.5</u>	<u>1,360.2</u>	<u>1,354.4</u>	<u>1,345.4</u>
Launch Vehicle Development	1,450.5		1,339.8	1,312.9	1,312.5	1,277.6	1,268.7
SLS Program Integration & Support	47.0		45.1	43.6	47.7	76.7	76.7
<u>Exploration Ground Systems</u>	<u>304.5</u>	-	<u>318.2</u>	<u>408.4</u>	<u>414.2</u>	<u>436.8</u>	<u>445.8</u>
Exploration Ground Systems	304.5		318.2	408.4	414.2	436.8	445.8
Subtotal, Exploration Systems Development	3,002.0						
Less Rescissions	(0.4)						
Commercial Spaceflight	406.0	0.0	821.4	821.4	821.4	590.0	371.0
<u>Commercial Cargo</u>	<u>14.0</u>	-	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>
Commercial Orbital Transportation Services	14.0		0.0	0.0	0.0	0.0	0.0
<u>Commercial Crew</u>	<u>392.0</u>	-	<u>821.4</u>	<u>821.4</u>	<u>821.4</u>	<u>590.0</u>	<u>371.0</u>
Commercial Crew	392.0		821.4	821.4	821.4	590.0	371.0
Exploration Research & Development	299.7	0.0	364.2	340.8	347.8	390.7	398.7
<u>Human Research Program</u>	<u>157.7</u>	-	<u>165.1</u>	<u>164.6</u>	<u>169.5</u>	<u>175.4</u>	<u>180.0</u>
Human Research Program	157.7		165.1	164.6	169.5	175.4	180.0
<u>Advanced Exploration Systems</u>	<u>145.3</u>	-	<u>199.0</u>	<u>176.2</u>	<u>178.3</u>	<u>215.3</u>	<u>218.7</u>
Advanced Exploration Systems	145.3		199.0	176.2	178.3	215.3	218.7
Subtotal, Exploration Research & Development	303.0						
Less Rescissions	(3.3)						
Subtotal, Exploration	3,711.0	3,793.9	3,915.5	3,952.0	3,970.7	3,799.0	3,589.3
Less Rescissions	(3.7)	(3.7)					

2014 Space Operations Budget

National Aeronautics and Space Administration FY 2014 PRESIDENT'S BUDGET REQUEST SUMMARY

Budget Authority (\$ in millions)	Fiscal Year						
	Actual 2012 ¹	Estimate 2013 ²	Request 2014	2015	Notional 2016	2017	2018
Space Operations	4,184.0	4,249.1	3,882.9	4,014.9	3,996.2	4,167.9	4,377.6
Space Shuttle	596.2	(3.1)	0.0	0.0	0.0	0.0	0.0
<u>Space Shuttle Program</u>	<u>599.3</u>	-	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>
SPOC Pension Liability	515.0		0.0	0.0	0.0	0.0	0.0
Program Integration	60.5		0.0	0.0	0.0	0.0	0.0
Flight & Ground Operations	19.0		0.0	0.0	0.0	0.0	0.0
Flight Hardware	4.8		0.0	0.0	0.0	0.0	0.0
Subtotal, Space Shuttle	599.3						
Less Rescissions	(3.1)						
International Space Station	2,789.9	0.0	3,049.1	3,169.8	3,182.4	3,389.6	3,598.3
<u>International Space Station Program</u>	<u>2,789.9</u>	-	<u>3,049.1</u>	<u>3,169.8</u>	<u>3,182.4</u>	<u>3,389.6</u>	<u>3,598.3</u>
ISS Systems Operations & Maintenance	1,378.7		1,318.9	1,258.7	1,259.2	1,330.3	1,329.1
ISS Research	225.5		226.4	229.3	236.4	239.6	249.6
ISS Crew & Cargo Transportation	1,185.7		1,503.8	1,681.9	1,686.7	1,819.7	2,019.6



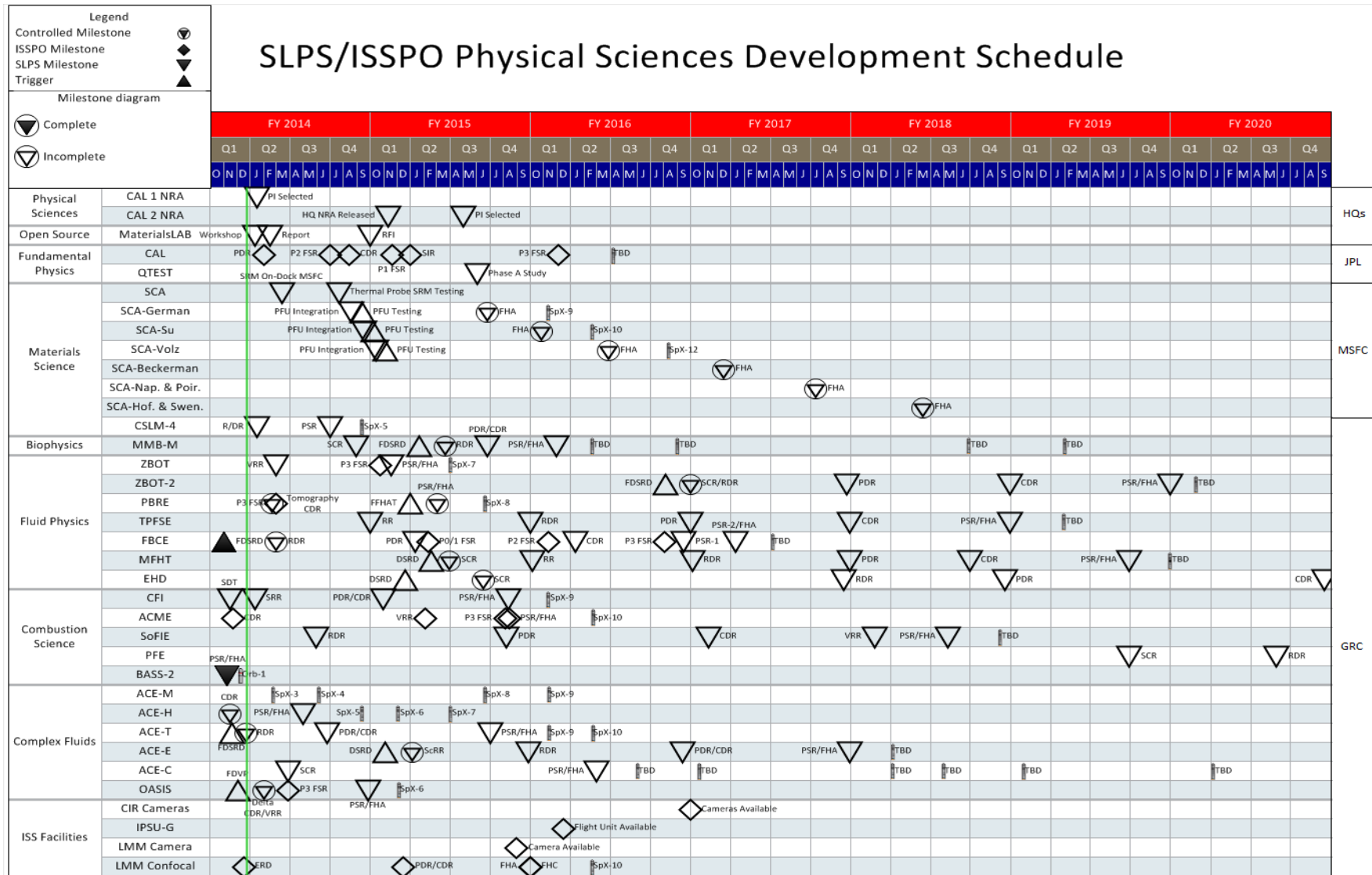
Space Biology and Physical Sciences Content

- **Next charts show research and flight project planning**
- **Major new efforts include geneLAB, Cold Atom Lab, Rodent Research Missions, Fruit Fly Lab, new plant research hardware**

BPS/ ISSPO Integrated Schedule (PS)



SLPS/ISSPO Physical Sciences Development Schedule

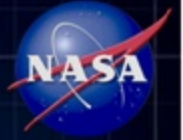


Signature: _____

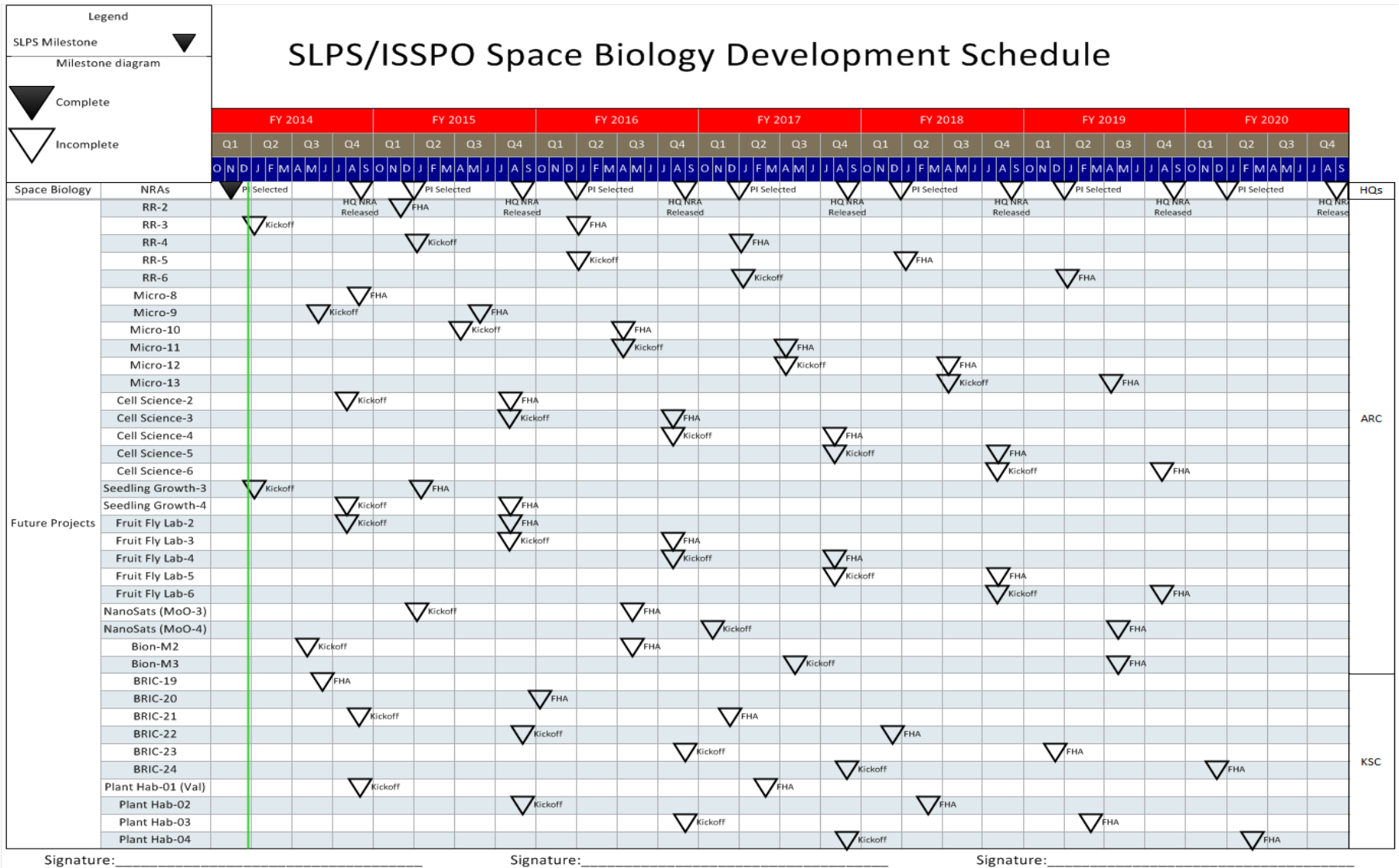
Signature: _____

Signature: _____

BPS/ ISSPO Integrated Schedule (SB)



SLPS/ISSPO Space Biology Development Schedule



Biological and Physical Science FY14 Budget Strategy



- The FY 2014 Cost mark is \$112.7M which includes \$44M that was carried over from FY 2013
- Biological and Physical Sciences (BPS) costed \$20.5M at the end of the quarter, averaging about \$7M per month (average should increase because CASIS costs were lower in the first quarter, sequestration and centers have new guidance for FY 2014 and out)
- In PPBE15 BPS was able to internally fund center-requested overguides for additional research and PI-specific hardware, with the assumption of being able to fund those overguides in the outyears with nearterm uncoded carryover, therefore uncoded carryover will be higher in the early years and will decline in the outyears
- CASIS costing will increase because of new RFPs; they are currently costing a little over \$1M per month

Accomplishments



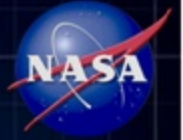
Programmatic:

- Continued socializing Open Source Science concept, geneLAB, materialsLAB, etc. within NASA, OMB and congressional staff.
- Held SLPS/ ISSPO Quarterly review with centers at JPL in July and at JSC in November.
- Pre-flight preparations underway for the ten BPS experiments set to be launched on Space X3
- Recovered from government shutdown with some impact to projects. Delays to CAL NRA selections, APH delta PDR, CAL PDR, etc. All impacts have been addressed and recovery plans are in place.
- Organized, gave presentations, held international meetings and chaired sessions at the joint American Society for Gravitational Space Research-29/ International Symposium for Physical Sciences in Space-5 (ASGSR-29/ ISPS-5) Conference, Nov.3 -8, 2013 in Orlando, FL. There were 38 Physical Science Sessions, 14 Life Science Sessions, International agency speakers, CASIS workshop, Open Source Science workshop, Suborbital workshop, etc.

Physical Sciences:

- Successfully completed the Systems Requirements Review (SRR)/ Requirements Definition Review (RDR) for the Cold Atom Lab (CAL) project and received Authority to Proceed (ATP) from RICB.
- Released Fundamental Physics (CAL) NRA. High interest from the community including multiple Nobel Prize winners planning to propose to the NRA.
- Organize, present program overview, and discuss potential international collaborations at the International Microgravity Strategic Planning Group Meeting, (IMSPG) Nov 8-9, 2013, Orlando FL.

Accomplishments



Space Biology:

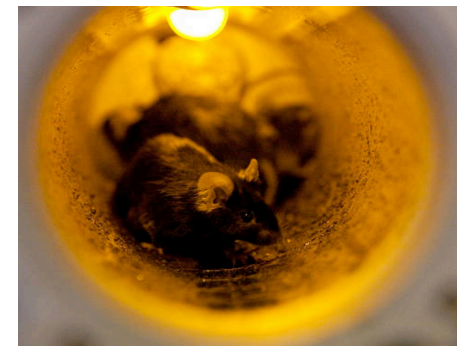
- Awarded 30 new grants in Space Biology, including nine flight investigations.
- Rodent Research Project Science Requirement Envelope Document (SRED) signed by approved by SLPSRA Director with CASIS and ISSPO concurrence.
- Space Florida lease in place as primary Animal Care Facility (ACF) for pre and post flight animal care operations for Space X4 flight.
- Conducted Fruit Fly Lab (FFL-01) Systems Requirements Review (SRR) and received ATP from RICB.
- Completed BIOS experiment (cell science) Critical Design Review (CDR) and ATP letter for RICB is under review.
- Conducted Advanced Plant Habitat (APH) PDR in June, not all aspects were considered at PDR level by the review board. Delta PDR conducted in October 2013.
- Successfully completed ECAMSat project CDR.
- Completed on-orbit troubleshooting of ABRS1 with no joy. Unit to be returned to the ground for further analysis, in the process of identifying other venues to accomplish PI science.

Accomplishments



Space Biology: (cont.)

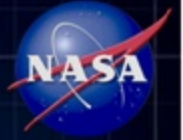
- Broke ground for the KSC Animal Care Facility, facility on schedule to support first rodent research science flight on Space X6.
- KSC and ARC working together to develop an integrated Bio-regenerative plan to seek BPS funding during PPBE 16.
- Work continues at ARC on a Phase A mouse centrifuge feasibility assessment. Results of study to be presented at SLPS/ ISS quarterly this month.
- Work continues at ARC on science cell hardware vs. science needs survey. Results to be presented at quarterly.
- Work continues on BION M-1 (rodent research in Russian vehicle) post-flight sample analysis.



CASIS Activities

- CASIS Board Chair, France Cordova, nominated as NSF Director. Choice of new chair and additional members are important issues for NASA
- Board has drafted a strategic plan reflecting the Board's ideas on the role of CASIS in support of NASA's missions
- Former astronaut Greg H. Johnson named CASIS Executive Director
- Third CASIS research RFP (for stem cell research) closed on July 26
- CASIS strategy for business development evolving toward "ecosystem" approach – relies on developing relationships in research hotbeds- MassChallenge (a startup incubator) in Boston area; Houston; Denver; Silicon Valley. Currently working on development of 11 projects from MassChallenge
- Research cooperation between SLPS and CASIS is growing – shared specimens on the Rodent Research-1 project; joint workshop on systems biology and omics applications to space research; transition of Binary Colloid Aggregation Test hardware to CASIS-supported project.

Planned Activities



Programmatic:

- Kick off FY14 phasing plan activities.
- Hold SLPS/ ISSPO Quarterly review with centers at MSFC at the end of January.
- Deliver ten experiments for Space X3 launch.
- Develop guidance in response to ISS extension to 2024 and provide to implementing centers.
- Continue working with ISSPO and implementing centers to address MI&O costs issues.

Physical Sciences:

- Organize, prepare and deliver presentations, and chair sessions at the materialsLAB Workshop in mid- April. Workshop report will guide Materials Science priorities.
- Resolve funding issues, complete selection process and announce CAL NRA PI selections.
- Conduct CAL PDR.
- Begin experiment ops for investigations launching on Space X3.

Planned Activities



Space Biology:

- Kick-off geneLAB project activities.
- Support Space X4 rodent research hardware validation pre-flight activities.
- Complete all activities, including certification of KSC ACF in support of Space X6 rodent research science flight.
- Complete Facility Trial Run (FTR) at KSC for rodent research Space X4 flight.
- Deliver mouse centrifuge Phase A feasibility study by EOY CY2013.
- Complete orderly shut down of ABRS1 and work with program office to return unit to the ground at the earliest opportunity.
- Continue working with KSC and ISSPO to identify new venues to accomplish the science for the PI affected by the ABRS1 malfunction.